United States Department of Agriculture	**Forest Service**	**Wallowa-Whitman National Forest**	**La Grande Ranger District 3502 Highway 30 La Grande, OR 97850**

Date: 05/28/2015

Subject: East Face – Fire/Fuels Effects

To: Cindy Christenson

Introduction

Cohesive Wildland Fire Management Strategy (National Strategy)

The objectives of the treatments within the East Face project are tiered to the goals identified in the National Strategy. Those goals are:

1. Restore and maintain landscapes so that all jurisdictions are resilient to fire related disturbances in accordance with management objectives.
2. Create fire-adapted communities so people and infrastructure can withstand a wildfire without loss of life or property.
3. Improve wildfire response so all jurisdictions participate in making and implementing safe, effective, efficient risk based wildfire management decisions.

Existing Fire behavior within the East Face project area has the potential to be very erratic, very fast spreading and very resistant to being suppressed as demonstrated by past wildfires (Anthony Creek and Tanner Gulch fires). Large portions of the project area consist of hazardous fuels conditions with a high potential for crown fire (reference Fire Behavior Appendix).

The purpose and need is represented by the difference or "gap" between the existing condition and its desired condition based on Forest Plan management direction. Therefore, there is a need:

- To actively manage surface, ladder, and crown fuels to provide strategic and safe areas for fire suppression activities. These strategically placed fuels reduction treatments would modify potential fire behavior thus slowing the progression of a wildfire and allowing for increased suppression opportunities.
- To restore and promote forest structural and compositional conditions reflective of historic ranges of variation where appropriate.
- To enhance landscape resilience to future wildfire, insect and disease risk.
- To capitalize on the opportunity to apply cohesive wildfire strategy principles across all land ownerships.

Defensible Fuels Profile Zones

An important component when managing forest for wildfire is to provide treated areas or Defensible Fuels Profile Zones that disrupt or alter fire progression and or enhance suppression opportunities.

Defensible Fuels Profile Zones (DFPZ) are not designed to stop fires but to allow suppression forces a higher probability of successfully attacking a wildfire. Creation of DFPZ's is proactive approach to affect fire behavior in anticipation of a future wildfire. The effectiveness of a DFPZ depends not only its design characteristics (size, location and type of treatment) but also on the behavior of fires approaching it. Such behavior is strongly determined by fuel spatial pattern in the

adjacent areas and any thinning beyond the fuel break will improve its effectiveness. Consequently, fuel treatments in adjacent lands would determine fuel break width and canopy alteration.

Spotting distance from torching trees is also a major factor in determining the width of a DFPZ. Fire behavior modeling has shown that spotting distance over a ½ mile can be expected under large fire environmental conditions (reference Fire Behavior Appendix).

A DFPZ is created by reducing surface fuels, increasing the height to the base of the live crown, and opening the canopy by removing undesired trees. Implementation of the treatments which modify those stand characteristics would change the behavior of a wildfire entering the fuels-altered zone.

East Face treatments would be designed to create DFPZs by:

1. Reducing surface fuel loads
2. Increasing crown base heights
3. Reducing canopy densities
4. Retaining the largest healthiest trees to create shade and moderate wind speed.

Table 1 - Scientific Principles of Fire Behavior

Principle	Effect	Advantage
Reduce surface fuel loads	Reduces potential flame length/fire intensity	Increases fire suppression opportunities and probability of success
Increase crown base heights	Requires longer flame length to begin torching	Reduced probability of torching
Reduce canopy density	Makes tree to tree crown fire less probable	Reduced crown fire potential.
Retain larger trees	Thicker bark and higher crowns	Moderates wind speed and shades fuels

Priority Areas for Treatments

The East Face project has been divided into the following 3 areas based on their proximity to private property, values at risk from wildfire, and/or logical locations for suppression operations.

Priority One Treatments (All *WUI areas and project areas within 1.5 miles of private land*)

Dense mixed conifer stands with heavy accumulations of dead and down material have created hazardous fuels conditions along the forest boundary and within the Wildland Urban Interface (WUI). There is a need to strategically place treatments in areas that would slow the progress of wildfire towards the WUI, while providing a defensible fuels profile zone (DFPZ) for firefighting resources. Dense stands with heavy accumulations of dead and down material have created hazardous fuels conditions within the adjacent Twin Mountain, Beaver Creek and Upper Grande Ronde IRA's. The potential for extreme fire behavior coupled with limited access severely limits fire suppression opportunities within the IRA's.

Treatments would be focused on:

- Creating a DFPZ along the boundary between public and private owned land.
- Creating a DFPZ along forest service road systems 43, 7302, 7307 and eastern portion of 73.
- Floodwater Flats Recreation Residence Tract and Anthony Lakes Ski Resort; fuels treatments would minimize potential damage to the physical improvements, while providing defensible space for firefighting resources.

- Along the northern edge of the Twin Mountains Inventoried Roadless Area adjacent the 73 road. Fuels treatments placed along this road to the north along the ridge top would increase suppression opportunities by creating a DFPZ.

Priority Two Treatments (*Strategic placed fuels breaks outside of the WUI or not with 1.5 miles private property)*

The proposed fuels reduction treatments would be anchored into the existing road system and reinforced by natural barriers. These treatments would not be designed to stop a wildfire but provide suppression forces a higher probability of successfully attacking a wildfire with indirect suppression tactics (such as burn outs) and improve access and egress for firefighting resources. Treatments would be focused on:

- Create DFPZ' along Forest Service roads 4380, 4350, 4315, 4320 7312
- The creation of a DFPZ along the 73 would increase opportunities for both planned and unplanned fire within the Twin Mountain Roadless.
- Compartmentalize the project area to limit the wildfire size.

Priority Three Treatments *(Treatments not within WUI or within 1.5 miles of private, or not part of a strategic fuels break).*

There is need to restore and promote forest structural and compositional conditions reflective of historic ranges of variation across the planning area. Treatments would be designed to manage vegetation for multiple purposes, including hazard fuels reduction, ecosystem restoration or maintenance, silviculture and wildlife.

- Reintroduce fire as disturbance mechanism and maintenance tool in dry forest types.
- Increase the abundance of fire tolerant tree species (western larch, Douglas fir and ponderosa pine) where appropriate.

EFFECTS ANALYSIS

This analysis addresses the effects of implementing the proposed alternatives for the East Face project area in relation to the key issue "Fire Behavior Potential".

A number of factors including canopy base heights, crown fire potential, rates of spread and flame lengths were analyzed in determining differences between alternatives (reference detailed modeling results in the Fire Behavior Appendix). Fire managers are interested in flame lengths, fire rates of spread and crown fire potential because it determines what suppression strategies would be most effective.

The **Key indicators** used to compare the alternatives were:

Acres of treatments by Priority Area – Number of acres of treatments that are proposed within each priority area.

Size of fire in acres on hour after igniton – a realitive measure to compare wildfire spread rates.

Fire rate of Spread – Distance a fire will spread in one hour.

Fire Flame Length – The length of the flame in a spreading fire within the flamimg front.

Torching Index - is the 20 foot wind speed at which a ground fire will torch into the crown initiating a crown fire. The lower the torching index, the lower the wind speeds need to be to initiate torching. A torching index of 0 means that there is a very high potential for a crown fire to occur.

Crowning Index - is the 20 foot wind speed at which active crown fire is possible. The lower the crowning index, the lower the wind speeds need to be to initiate active burning in the crown and spread through the canopy. A low crowning index (closer to 0) indicates that there is a very high potential for an active crown fire.

Method of Analysis

Assumptions:

The direct and indirect effects analysis area for fire and fuels resources encompasses all of the East Face project area along with Elkhorn Wildlife Area and the adjacent private lands within 1.5 miles of the project boundary.

The cumulative effects analysis area for the East Face project is as follows:

- The cumulative effects boundary for vegetative treatments which modify fire behavior encompasses the Powder River-Wolf Creek and North Powder River (HUC 5) watersheds and the Upper Beaver Creek, Limber Jim Creek, Tanner Gulch Grande River and Upper Ladd Creek HUC 6 sub watersheds.
- The cumulative effects boundary for smoke generated from both prescribed and wild fire encompasses Union, Baker, Umatilla, and Grant counties.

Modeling Groups

The stands within the project area were grouped into three modeling groups based on Potential Vegetation Group (PVG), surface fuel loadings, crown fuel characteristics and potential fire behavior. Field inventory was completed on representative stands within each of the modeling groups to gather surface and crown fuel data (to determine FCCS Fuel Group – as described in the Fire/Fuels Existing Condition report). This data was then extrapolated to all the stands within each of the modeling groups and input into fire behavior models. The following table displays how the modeling groups were defined.

Table 2- East Face Modeling Groups

Modeling Group	PVG	Species description	Fire Regime	Representative FCCS Fuel Bed	Acres of project area represented by modeling group
1	Dry Upland Forest	Ponderosa Pine - Mixed Conifer	1	1530	4,500
2	Cold Upland Forest	Lodgepole Pine, Anthony Creek Fire	3/4	1590 / 1593	15,841
3	Moist Upland Forest	Grand Fir – Mix conifer	3	1545	7,614

Fire behavior modeling and observed fire behavior from past wildfires within or near the project area were used to predict both existing and post treatment fire behavior. Environmental inputs for modeling were obtained from weather records at the closest weather station. Fire behavior fuel models are used as input to the Rothermel (1972) fire spread model, which is used in a variety of fire behavior modeling systems. The fuel models used in this analysis are from Scott and Burgan's "Standard Fire Behavior Fuel Models" (RMRS-GTR-153, June, 2005). The Fuel Models used in this analysis to represent pre-treatment and post treatment conditions are:

- TU5 (pre-treatment) – The primary carrier of the fire is forest litter with a shrub or small tree understory.

Predicted fire behavior for post treatment vegetation in the timbered stands was modeled as

- TL3 (post-treatment) – The primary carrier of the fire is a moderate load of conifer litter and a light load of coarse fuels.

Duration of Effectiveness

The duration of the effectiveness of the fuels reduction treatments in the action alternatives has been categorized by modeling group:

Modeling Group 1 / Dry Upland Forest stands will require a low intensity maintenance burn within 10 to 15 years after completion of the proposed actions. These treatments will be designed maintain fire tolerant tree densities and surface fuels at appropriate levels.

Modeling group2 / Cold Upland Forest stands comprised of mostly lodgepole will require a mechanical treatment such as PCT to maintain desired tree composition and densities within 20 years after the completion of the proposed actions. Surface fuels will be maintained at appropriate levels with a combination of mechanical fuels techniques such as mastication or grapple pile and burn. A commercial thin will be required within 30 years to maintain canopy densities at levels which have low potential for crown fire.

Modeling Group 3 / Moist Upland Forest stands will require a mechanical treatment such as PCT to maintain tree densities within 15 to 20 years after the completion of the proposed actions. Surface fuels will be maintained at appropriate levels with a combination of prescribed underburning and mechanical fuels techniques such as mastication. A commercial thin will be required within 30 years to maintain canopy densities at levels which have low potential for crown fire.

Weather Conditions

Fuels Management Analyst Suite was used to make fire behavior predictions. Environmental conditions and weather inputs were derived from data from the Johnson Ridge Remote Automated Weather Stations (RAWS). Stand exam data backed up by field recon were used to determine stand characteristics used in the fire behavior modeling.

Models

The modeling results will show how the alternatives would change both surface and crown fire behavior within the project area. The following fire behavior and smoke emissions modeling programs were used in this analysis:

- **Fuels Management Analyst Suite** was used to make fire behavior predictions..
- **Fuels Characteristic Classification System (FCCS)** was used to make fire behavior predictions and visualizations.
- **Fire and Fuels Extension- Forest Vegetation Simulator (FFE-FVS**) will be used in this analysis to provide visual images of stand structures and fire behavior before and after fuels reduction treatments.
- **Fire Behavior Observations** from Tanner Gulch, Red Mountain and Anthony Creek wildfires.
- **BlueSky Playground 2.0 beta** used to model smoke emissions.

Alternative Summary

Alternative 1 - no actions are proposed under this alternative.

Alternative 2 (proposed action) - reduces potential fire behavior through reductions in surface fuels, ladder fuels, crown fuels and increases crown base heights. Creates defensible fuel profiles in strategic locations and increases fire fighter safety. Improves egress for fighting resources along the existing road systems.

Alternative 3 – modifies the proposed action by eliminating all regeneration harvest treatments, temporary roads, road reconstruction, harvest in LOS below HRV, treatments in PWA (units 104 and 105), treatments in MA15, treatments in connective corridors units and proposes only noncommercial treatments in Management Area 6 (Back Country)

Alternative 4 (modified PA) – modifies the proposed action by changing all priority area 2 commercial activities to noncommercial and eliminates all treatments in Moist/Cold PVG in priority 3 units.

Alternative 5 – modifies the proposed action to include ground based commercial biomass removal in PCT, WFH and WFM units.

Two broad categories of fuels treatments are proposed under the action alternatives:

Mechanical fuels reduction treatments – would reduce and/or remove surface, ladder and crown fuels including dead standing and down trees. Commercial thinning, improvement cuts, precommercial thinning, mastication, grapple piling, and hand piling are examples of mechanical fuels treatments. All thinning treatments would be followed by prescribed fire or other mechanical treatments such as mastication to reduce surface fuels thereby reducing the intensity of potential wildfires (*Graham, McCaffery and Jain. 2004).*

Surface fuels would be reduced to less than 10 tons/acre in the harvest/biomass removal units. Post-harvest slash treatments would primarily be mastication and jackpot burning.

Treatment units with no harvest or biomass removal would require a grapple or hand pile burn to reduce surface fuel to desired levels.

Prescribed fire treatments – are an effective means to reduce surface fuels, thin suppressed overstocked regeneration, increase canopy base height. These management ignited fires are implemented when fuel moistures are moderate, spring or late fall, and generally burn with lower intensity than wildfires. Fine fuels are burned, but most large diameter fuels are only

charred. Direct effects of prescribed fire include reducing surface fuel loadings and potential flame lengths, thus reducing potential fire behavior. Because prescribed fires are less intense and less severe than most wildfires, they are less likely to damage soils and kill overstory trees. Control lines would include roads, natural barriers and brush removal rather than bare mineral soil line construction where possible. Existing standing large snags (>12 inches, DBH) would be protected during firing operations through avoidance or fuels reduction (FDR) as practical.

Table 11 - Acres of Mechanical Treatments by Priority Area

Priority Area	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
1	0	8,619	7,358	8,619	8,686
2	0	7,856	6,058	7,856	8,379
3	0	623	238	25	971
Total	**0**	17,098	13,654	16,500	18,036

Table 12 - Acres of prescribed fire treatments

Treatment	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Jack Pot Burn	0	3,835	2,820	2,823	4,150
Site Prep Burn	0	127	0	26	127
Natural Fuels Burn	0	6,685	6,043	6,643	6,685
Grapple Pile Burn	0	5,425	3,615	6,540	2,309
Hand Pile Burn	0	2,102	3,090	4,099	3,929
Total	**0**	18,174	15,568	20,131	17,200

Table 13 - Emissions from Prescribed Fire Treatments

Emission (Tons)	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
PM 10	0	3,266	2,656	3,488	2,900
PM 2.5	0	2,809	2,282	2,992	2,491
CO	0	25,646	20,904	25,460	24,210
CO2	0	498,381	404,218	570,355	413,885
Green House Gasses (GHG's)	0	559,323	453,868	632,307	470,323

DIRECT AND INDIRECT EFFECTS

A. FIRE BEHAVIOR POTENTIAL

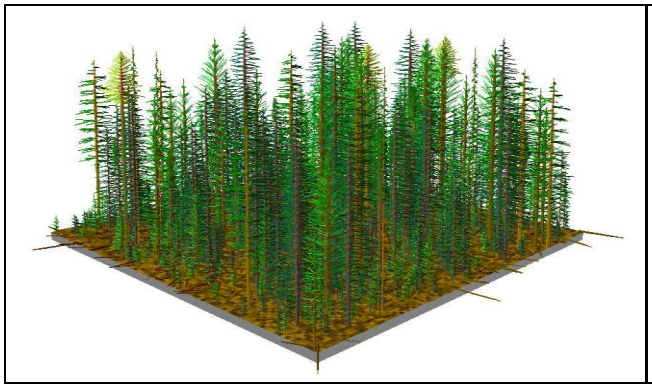
ALTERNATIVE 1- No Action

The "no action" alternative would result in no reduction in surface or canopy fuel loadings and as a result the potential for adverse effects from a high intensity wildfire will remain high. Within the analysis area, multi-layered stand structures, tree densities and live vegetation continue to grow. Also, surface fuels continue to accumulate, creating conditions that allow fire to move vertically from the surface level to the forest crown. Overstocked stand conditions will continue to increase the susceptibility of the stands to insects and disease, resulting in increased surface and crown fuel loadings and associated fire behavior potential. These conditions will continue to limit firefighting opportunities, pose undesirable risk to private property, firefighter and public safety, and continue the risk of damaging impacts to natural resources.

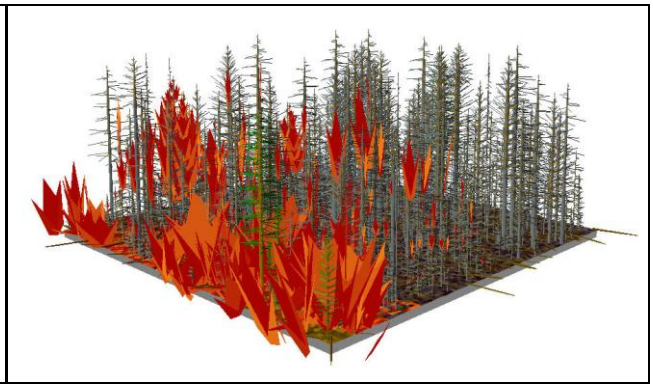
The following fire behavior simulations were created using FVS-FFE (reference Fire Behavior Appendix), existing stand conditions data and large fire weather parameters were used to create the wildfire scenario.

Modeling Group 1 – Dry Upland Forest

Existing Stand

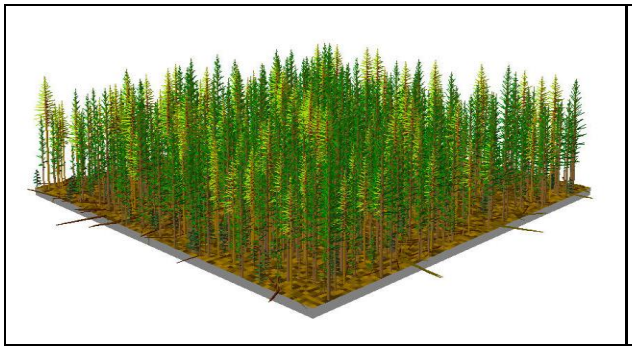


Wildfire with existing conditions

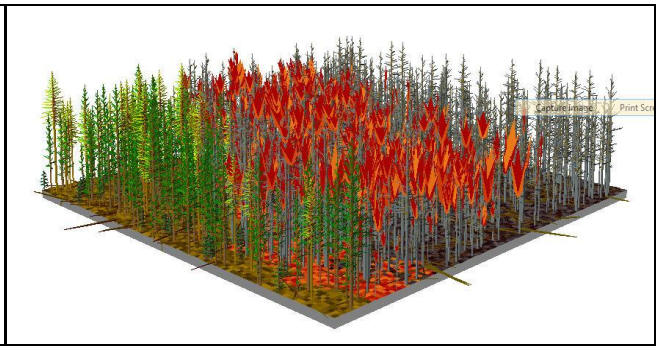


Modeling Group 2 – Cold Upland Forest

Existing Stand

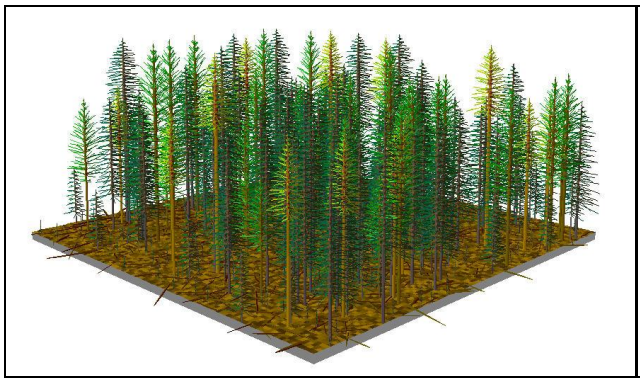


Wildfire with existing conditions



Modeling Group 3 – Moist Upland Forest

Existing Stand



Wildfire with existing conditions

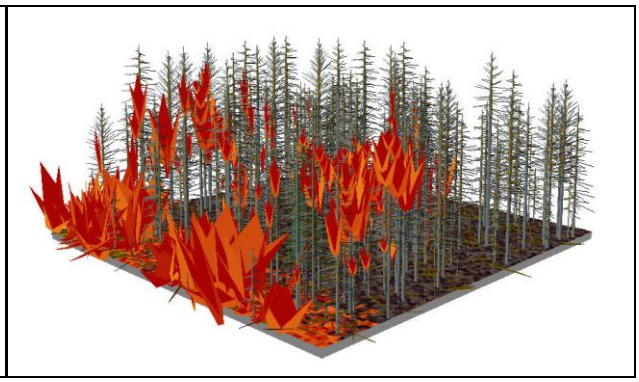


Table 3 - Potential Fire Behavior with Implementation of Alternative 1

Characteristics	Modeling Groups		
	1 (Dry Upland Forest)	**2** (Cold Upland Forest)	**3** (Moist Upland Forest)
Surface Fuel Model	TU5	TU5	TU5
Basal Area	172	196	150
Canopy Base Heights	1	3	2
Fire Rate of Spread (ch/hr)	48	52	43
Fire Flame Length (ft)	45	54	46
Fire size 1 hour after ignition (acres)	63	85	59
Torching Index	0	0	0
Crowning Index	42	26	36

(Reference Fire Behavior Appendix for Detailed Modeling Information)

The existing low canopy base height facilitates ignition of the crown fuels by a surface fire. The canopy bulk density exceeds the threshold values for crown fire. Crown height is used as the upper level of the crown space for determining crown fuel loading and the starting height of lofting embers". Many of the stands within the project area have high potential for long range spotting potential due to the heavy surface fuel loading and associated surface fire intensity.

Direct and Indirect effects of Alternative 1 are:

1. Stand structure and function would continue to move further from historical range of variability in fire regimes one and three.
2. A continuation of heavy surface fuels capable of producing extreme fire behavior.
3. Crown fire potential remains high.
4. High potential for a crown fire to initiate within the project area and spread on to State and private property.
5. Lack of functional DFPZs in the Rock Creek Bulger and Anthony Lakes WUI places private property and recreation residences at risk to wildfire.
6. Lack of DFPZs adjacent to the Twin Mountain, Upper Grande Ronde and Beaver creek IRAs limit suppression options and decreases firefighter safety.
7. Rate of fire spread exceeds the production rates of initial attack hands crews in direct attack methods decreasing the likelihood of containing a fire while it is still small.
8. Lack of DFPZs limit options for suppression activities and the ability to strategically contain a fire within smaller blocks of land which are surrounded by areas of reduced fuels from which to safely direct or indirect attack the fire (compartmentalize).
9. Prescribed burning opportunities are limited due to the high risk of escape and potential for smoke intrusions into La Grande and Baker City.
10. Increased risk of damaging impacts to soil, vegetation and watersheds from high intensity/severity wildfire.
11. Wildfire suppression costs would continue to increase without treatment of hazardous fuels due to the increased likelihood of larger fires requiring extensive firefighting equipment and manpower.
12. Decrease in forest resistance to fire, drought, and disease from increasing density of trees.
13. Lack of safe egress routes for suppression resources due to heavy fuel loading adjacent to major road systems.
14. High probability that fire brands from torching trees will cross fire lines constructed in areas that have had no pretreatment.

15. Delayed response times for initial attack resources due to the ingrowth of vegetation in existing road beds and lack of road maintenance.
16. Landscape resiliency to future wildfire, insect and disease risk remains low.

Summary: This alternative would not meet the purpose and need for this project because it does not create DFPZs or reduce potential fire behavior. Excess surface, ladder and crown fuel loadings would remain in critical locations within the project. Tree densities and live vegetation would continue to grow and dead wood would continue to accumulate, creating fuel conditions that allow fire to easily move vertically from the surface level into the forest canopy.

Overstocked stand conditions would continue to increase the susceptibility of the stands to mortality from insects and disease resulting in increased surface and crown fuel loadings and associated fire behavior potential. The current fuels profile and poor egress routes limit fire suppression opportunities, decrease firefighter and public safety, increase the risk for loss of private property and natural resources and increase negative impacts to visuals.

Wildfire suppression strategies within this project area would have to rely heavily on indirect tactics with burnout operations near or on private property under this alternative. The existing hazardous fuels conditions and associated fire behavior potential increase the likelihood of fire control problems, spotting across fire lines, and increased risk to private land, roadless areas, and the municipal watershed.

The cohesive wildfire strategy principles would only be implemented on the adjacent private and state managed lands.

ALTERNATIVE 2

Treatments proposed in Alternative 2 modify vegetative structure and fuel loadings to reduce wildfire behavior, increase firefighter and public safety, and improve landscape resiliency. Fuels treatments in this alternative are not designed to stop wildfires but rather to modify fire behavior. Firefighters can often use treated areas to increase fire suppression effectiveness and limit fire spread. The DFPZ's created in this alternative provide a fire suppression anchor point to reduce the potential of landscape-level wildfire.

Accessibility is also important in fighting forest fires. Many fires which burn large acreage do so because firefighting equipment and personnel cannot reach the scene in a timely manner. The DFPZ's constructed adjacent to roads and the associated road maintenance would improve firefighter's response times and provide safe egress from a fire if needed. The sooner firefighters can safely reach a wildfire with equipment, the better the chances of preventing a small fire from becoming large.

DFPZ's would be created using a combination of harvest, thinning, pruning, burning and surface fuel reduction treatments. Completed treatments would assist fire managers in burn out operations. One of the most common firefighting techniques is the use of a controlled backfire to create a fuel break in front of an advancing fire. Treatments completed under this alterative would create DFPZ's in advance of a wildfire thus reducing the time needed to implement backfiring and containment strategies.

Fuel treatment strategies in Alternative 2 includes thinning (removing ladder fuels and decreasing tree crown density) followed by prescribed fire, piling and burning of fuels, or other mechanical treatments that reduce surface fuel amounts. This approach reduces canopy, ladder and surface

fuels, thereby reducing both the intensity of potential wildfires *(Graham, McCaffery and Jain. 2004. RMRS-GTR-120).* Many of the forested stands within the project area have not experienced fire or thinning for several decades, heavy thinning combined with (often multiple) prescribed-fire or other surface fuels treatments, or both is necessary to effectively reduce potential fire behavior and crown fire hazard *(PNW-GTR-628).* The proposed commercial thinning treatments that reduce canopy bulk density (crown closure) would reduce the potential for crown fire development if surface fuels are concurrently treated (*Cruz et al. 2002, Rothermel 1991, Scott and Reinhart 2001, van Wagner 1977)*.

"A surface fire may make the transition to some form of crown fire depending on the surface intensity and crown characteristics" (*Van Wagner 1977 and 1993*). Alternative 2 treatments reduce surface, ladder and crown fuels thus reducing potential fire behavior. Treatments would also maximize managing towards large fire resistant trees which create shade and decrease mid flame wind speed. Thinning treatments would be designed to leave the largest/healthiest trees on site to provide shading of surface fuels and partial sheltering surface wind speeds *(Fireline Handbook Appendix B Fire Behavior, 2006)*. Smaller diameter tree densities would be reduced to minimize the potential for crown fire initiation. This partially shaded gap between the surface and crown fuels would also minimize the potential for crown fire.

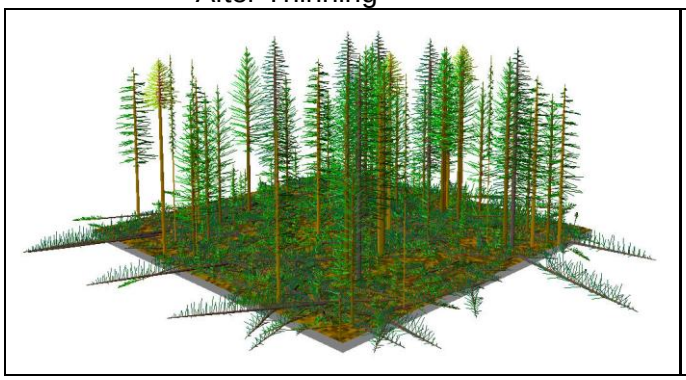
A reduction of surface and crown fuels reduces the potential for extreme fire behavior. Flame lengths would be reduced to intensities 4ft or less (Reference Fire Behavior Appendix) which allow firefighters to safely implement direct fire suppression tactics. Having the opportunity to utilize direct suppression tactics decreases the potential fire size, the risk to public and firefighter safety, the municipal watershed and private property.

The 6,722 acres of harvest treatment activities will create a short term increase in fine fuel loadings (3 inch minus size classes) immediately following harvest activities. It is anticipated that these fine fuel loadings are expected to range from 8-10 tons per acre. In all of these stands, post-harvest slash reduction treatments are planned. Fire hazards immediately following activities are not severely elevated due to the green nature of the slash. Depending on the weather, the slash could cure rapidly and present a short-term (several months) elevated hazard risk in the late summer before fall rains/snows arrive. A curing period is required to achieve desired fuel consumption when prescribed burning. Fuel loadings generally are compacted closer to the ground by winter snows (reducing the potential for crown fire) and after a period of drying in the late spring/early summer they are generally ready for prescribed burning. Therefore, if the fuels reduction treatment takes place within the year following harvest, there is a short term (3 months) period of elevated potential for high intensity burning conditions in the event of a wildfire during this period. This occurrence depends largely on weather conditions and the relatively low potential for an ignition in that exact same area. This risk would be immediately reduced following the completion of the activity. Should burning be delayed – this risk would remain in place for the hottest four months each summer for a 2 year period after which the fine fuels will be on the ground and decomposed to the point that they are no longer a flash fire hazard.

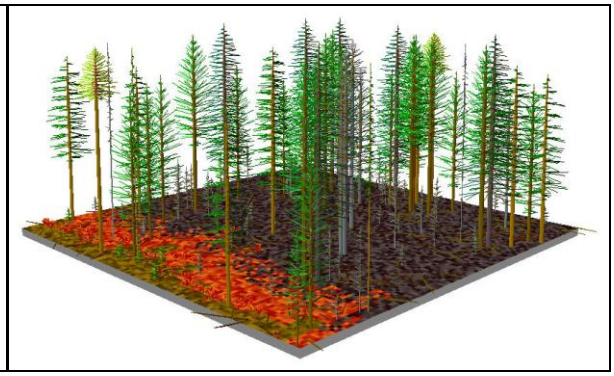
The following fire behavior simulations were created using FVS-FFE (Reference Fire Behavior Appendix). All modeling groups underwent a ladder/crown fuel reduction treatment and a post-harvest treatment to reduce surface fuel loadings. Existing stand conditions data and large fire weather parameters were used to create the wildfire scenario after completion of the proposed activities.

Group 1 – Dry Upland Forest

After Thinning

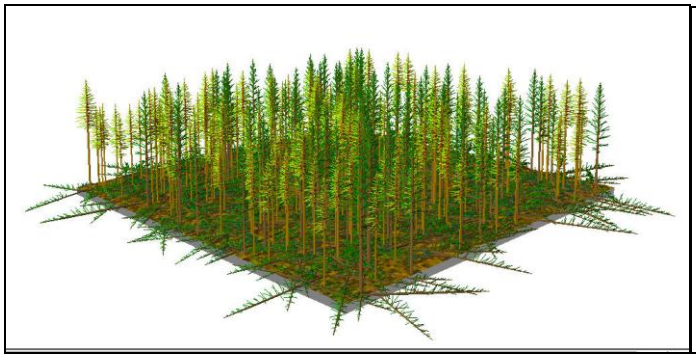


Wildfire after treatments

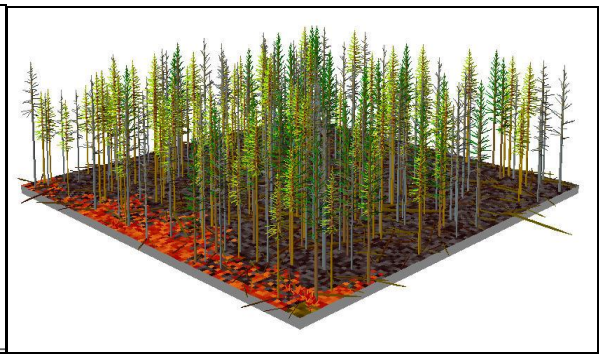


Group 2 – Cold Upland Forest

After Thinning

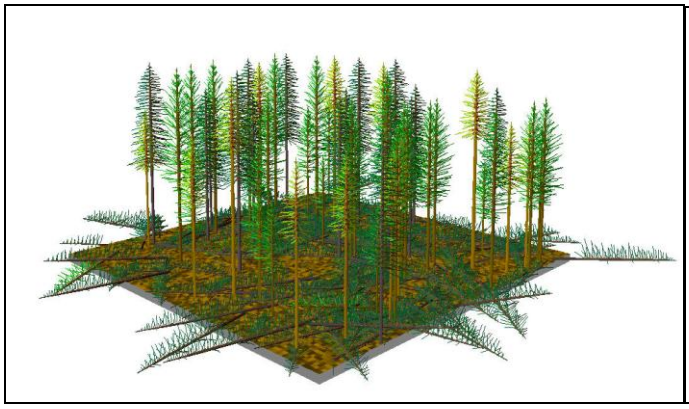


Wildfire after treatments



Group 3 – Moist Upland Forest

After Thinning



Wildfire after treatments

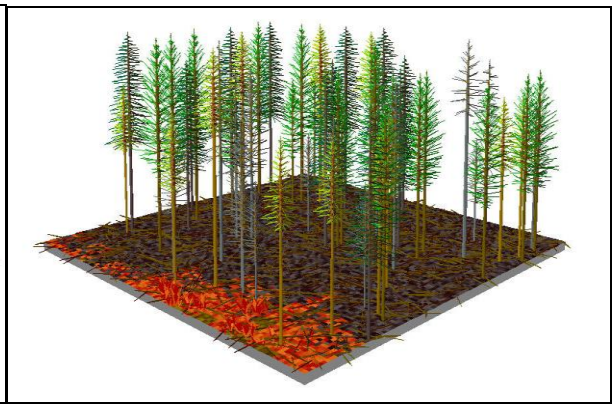


Table 5 - Potential Fire Behavior with Implementation of Alternative 2

Characteristics	Modeling Groups		
	1-Dry Upland Forest	2-Cold Upland Forest	3-Moist Upland Forest
Surface Fuel Model	TL3	TL3	TL3
Basal Area	106	103	103
Canopy Base Heights	21	9	14
Fire Rate of Spread (ch/hr)	3	3	3
Fire Flame Length (ft)	2	1	1
Fire size 1 hour after ignition	.3	.2	.3
Torching Index	496	255	225
Crowning Index	70	45	52

(Reference Fire Behavior Appendix for Detailed Modeling Information)

Direct and Indirect effects of Alternative 2:

1. A reduction of surface and crown fuels reduces the potential for extreme fire behavior.
2. Flame lengths would be reduced from an average of 50 feet to 1-3 feet on treated acres. Hand crews can use direct fire suppression tactics when flame lengths do not exceed four feet. Engines and dozers (where roads and terrain allow) can directly fight fire with 4-8 foot flame lengths. Having the opportunity to utilize direct suppression tactics decreases the potential fire size, the risk to public and firefighter safety, and private property.
3. DFPZ's created in strategically sound locations to initiate suppression operations, increase the probability of successfully containing a fire quickly.
4. Crown fire potential is reduced (refer to modeling results above).
5. Creation of a functional DFPZ's in the Rock Creek Bulger and Anthony Lakes WUIs decrease risks to private property and recreation residences from fire.
6. Reduction of surface and ladder fuels increases prescribed burning opportunities and decreases potential smoke emissions.
7. Creation of DFPZ's adjacent to the Twin Mountain, Upper Grande Ronde and Beaver creek IRA's increases suppression options and firefighter safety.
8. Prescribed fire treatments would produce smoke emissions noticeable to general public for short durations (less than 48 hours).
9. Reduced wildfire intensity and severity lessen the risk of damaging impacts to soil, vegetation, watersheds, and visuals.
10. Increased forest resistance to fire, drought, and disease from decreased density of trees.
11. The proposed road maintenance will improve wildfire initial attack response times and increase firefighter safety by improving egress routes.
12. Mechanical treatments would decrease the amount of pollutants generated during a prescribed burn or wildfire. Smaller less intense fires would produce less smoke.
13. Creation of safe egress routes for suppression resources due to a reduced surface fuel loading adjacent to major road systems.
14. Reduced probability that fire brands from torching trees will cross fire lines constructed in DFPZ's.
15. Cost of firefighting would be reduced with smaller, less intense wildfires. Fuel treatment costs over the next 20 to 30 years are expected to be reduced. A recent study on the Fremont and Okanogan National Forests show the cost of fuel treatment over time are cost effective when compared to the costs associated with wildfire and loss of revenues from forestlands (Mason and others, 2006).

16. The completion of the treatments in priority 3 units reduces tree densities to desired levels and increases the percentage of fire tolerant trees species on site.

Summary: Alternative 2 meets the purpose and need of this project, DFPZ's would be created using a combination of harvest, thinning, pruning, burning and surface fuel reduction treatments. Completed treatments would assist fire managers by reducing potential fire behavior in strategic locations. The DFPZ's constructed adjacent to roads and the associated road maintenance would improve firefighter's response times and provide safe egress from a fire if needed. DFPZ's would also result in the compartmentalization of the project area thus decreasing the potential wildfire size. This compartmentalization would provide fire managers with options to utilize confine and contain suppression strategies when appropriate.

Alternative 2 moves fire adapted ecosystems in the drier portions of the project area towards their range of historic conditions. Treatments would be designed to increase the percentage of fire tolerant tree species such as ponderosa pine, western larch and Douglas fir. Fire would be reintroduced into the project area, surface fuel loadings would decrease, and the gap in vegetation profiles between historical conditions and current conditions would decrease.

ALTERNATIVE 3

Alternative 3 modifies the proposed action by eliminating all regeneration harvest treatments, temporary roads, road reconstruction, harvest in LOS below HRV, treatments in PWA, treatments in MA15, and treatments in connective corridors units. Only noncommercial treatments would occur in the MA6 and in LOS below HRV.

Treatments not changed from Alternative 2 would have the same fire behavior modeled under that alternative. Units deferred from treatment consideration under this alternative would have fire behavior similar to that modeled under Alternative 1.

Mechanical fuel treatment strategies in Alternative 3 reduce surface fuels to the desired levels, but only partially decrease canopy density/basal area to the desired level in the treatment units that changed from commercial to noncommercial. This noncommercial treatment removes a portion of the ladder fuels (no trees above 7" DBH would be removed) which leaves the stands with higher than desired tree densities and canopy fuel loading.

Table 6 - Basal Area Post Treatment Comparison

Categories	Basal Area (Post treatment)		
	Group 1 – Dry Upland Forest	Group 2 – Cold Upland Forest	Group 3 – Moist Upland Forest
Existing Basal Area	172	196	150
Desired Basal Area	100	100	100
Basal area shown is for proposed action units that received a commercial thin (max cut dbh of <21"	106	103	103
Basal area shown is for the units that were commercial under the proposed action but changed to noncommercial (max cut dbh of 7").	158	164	145

The following table displays the fire behavior characteristics for the treatment units which only thin trees less than 7" DBH.

Table 7 - Potential Fire Behavior with Implementation of Alternative 3

Characteristics	Modeling Groups		
	Group 1 – Dry Upland Forest	Group 2 – Cold Upland Forest	Group 3 – Moist Upland Forest
Surface Fuel Model	TL3	TL3	TL3
Basal Area	158	164	145
Canopy Base Heights	6	8	12
Fire Rate of Spread (ch/hr)	6	3	5
Fire Flame Length (ft)	3	1	3
Fire size 1 hour after ignition	.9	.2	.7
Torching Index	39	225	138
Crowning Index	45	31	36

Reference Fire Behavior Appendix for Detailed Information

Implementation of Alternative 3 would eliminate the option for offsite removal of excess biomass on 2,843 acres. Prescription changes from commercial to noncommercial would:

- Diminish the effectiveness of the proposed crown fuel reduction treatments (trees greater than 7"DBH would not be cut).
- Create hazardous surface fuels loads, beyond what could be effectively jackpot burned, forcing expensive hand pile treatments.
- Increase the amount of material pile burned. It is estimated that 30 tons of biomass/acre would need piled and burned, increasing the potential for soil damage and increasing probability smoke intrusions into the local community.

The Twin Mountain, Upper Grande Ronde and the Beaver Creek IRA's are located adjacent to the project area. The potential for extreme fire behavior in these areas makes it more likely that suppression resources could be overwhelmed without adequate DFPZ's located adjacent to forest roads 43 and 73.

The 73 and 7307 roads are the primary access routes for firefighters on the southern portion of the project. Currently the fuels characteristics adjacent to the roads are comprised of hazardous fuels that are capable of producing extreme fire behavior. Alternative 3 eliminates treatments in the old growth (MA15) portion of unit 134 which leaves a gap in the proposed DFPZ. This 94 acre portion of the stand identified for treatment within the proposed action has stand structures (abundant ladder fuels with high canopy bulk density) and fuels profiles that would support high intensity crown fire. Lack of a DFPZ along the road system decreases opportunities to use this road system as a control line during fire suppression operations thus increasing the potential for a large, high intensity wildfire to spread northward out of the roadless area towards the Rock Creek Bulger WUI.

The duration of the effectiveness of the fuels reduction treatments under this alternative can be categorized by modeling group:

Modeling Group 1 / Dry Upland Forest stands – Due to higher crown fuel levels and fire intolerant tree species left within the stands, the initial prescribed fire applications would produce increased tree mortality. The trees killed would become surface fuels within 10 years and require another mechanical surface fuel treatment. Upon completion of that

treatment, low intensity prescribed fire would occur at a 10 to 15 year cycle, maintaining the stand in desired conditions.

Modeling group 2 / Cold Upland Forest stands – Overstocked stands comprised of mostly 55 year old lodgepole (high crown fuel loadings) would require a commercial thin within 15 years. Surface fuels would be maintained at appropriate levels with a combination of mechanical fuels techniques such as mastication or grapple pile and burn. A pre-commercial thin would be required within 20 years to maintain tree densities at appropriate levels.

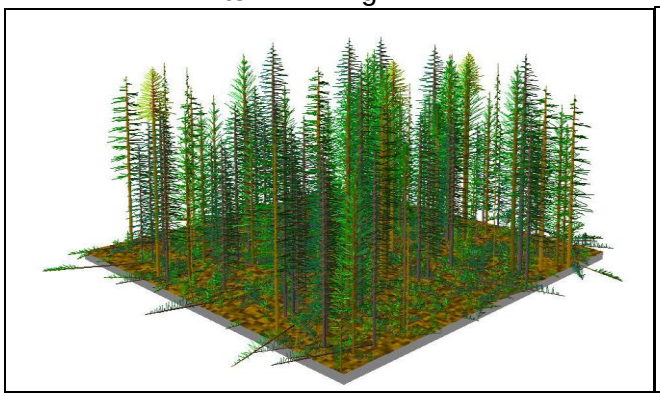
Modeling Group 3 / Moist Upland Forest – Fir dominated stand comprised of high crown fuel loadings would require a commercial thin within 15 years. Surface fuels would be maintained at appropriate levels with a combination of mechanical fuels techniques such as mastication or grapple pile and burn. A pre-commercial thin would be required within 20 years to maintain tree densities at appropriate levels.

The high density of trees remaining in the unit would prohibit grapple piling or mastication treatments from being implemented. The excess surface fuels would be hand piled to desired levels and burned late in the fall when the risk of escape would be minimal.

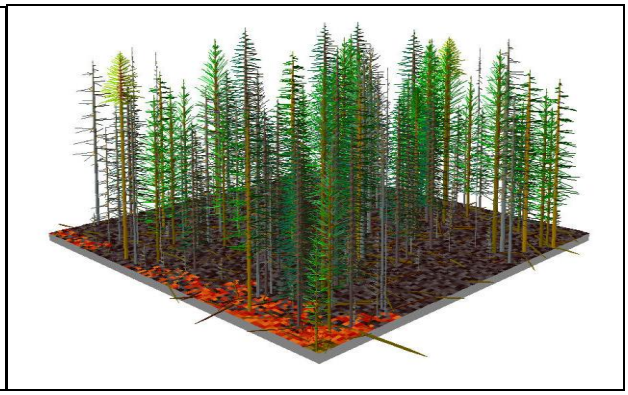
The following fire behavior simulations were created using FVS-FFE (Reference Fire Behavior Appendix). The modeling groups underwent a ladder/crown fuel reduction treatment only on tree less than 7" DBH and a post-activity treatment to reduce surface fuel loadings. Existing stand conditions data and large fire weather parameters were used to create the wildfire scenario after completion of the proposed activities. In units that have had the commercial removal deferred, crown fire potential would remain at a moderate to high level.

Group1 – Dry Upland Forest

After Thinning

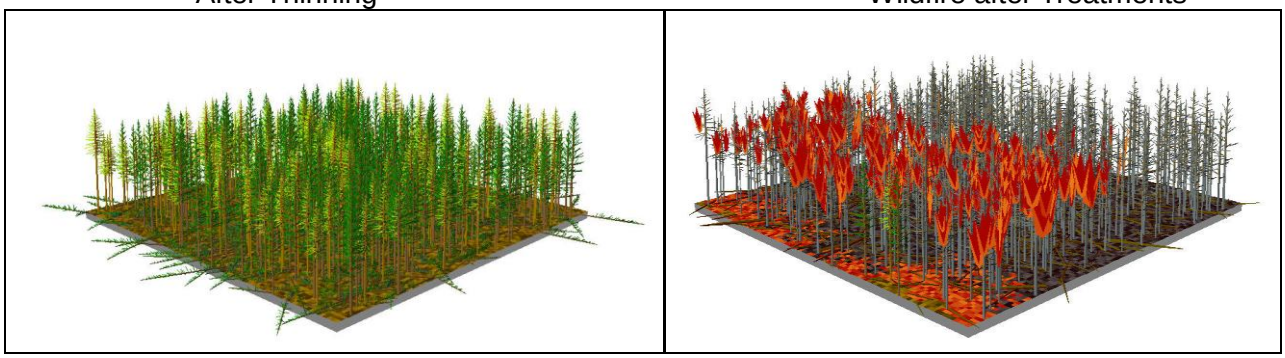


Wildfire after Treatments



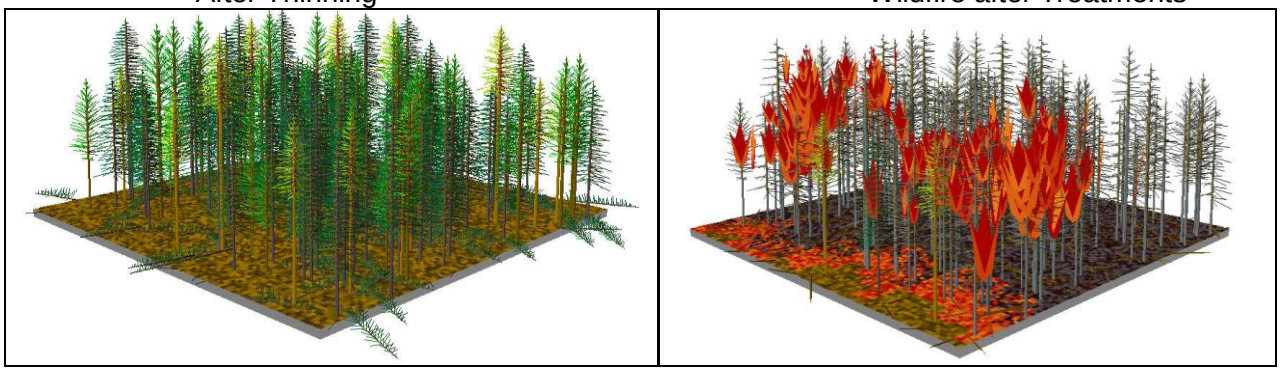
Group 2 – Cold Upland Forest

After Thinning | Wildfire after Treatments



Group 3 – Moist Upland Forest

After Thinning | Wildfire after Treatments



Direct and Indirect effects of Alternative 3:

1. The proposed DFPZ's would only be partially completed. The deferral of treatments would diminish the effectiveness DFPZ's by reducing the opportunities for suppression resources to anchor their activities into pre-existing fuels treatments.
2. The probability of trees torching within treatment units is reduced through surface and ladder fuel reduction treatments. But crown fire potential still remains high in units that had commercial removal deferred due to the remaining high canopy fuel loadings (Reference Fire Behavior Appendix)
3. Wildfire intensity and severity continue increase in stands that were deferred from treatment. The risk of damaging impacts to soil, vegetation and visuals would continue.
4. Decreased forest resistance to fire, drought, and disease from high density of trees in untreated stands.
5. The deferred road maintenance would continue to prolong wildfire initial attack response times and decrease firefighter safety due poor egress routes.
6. Deferral of treatments decreases the width of the DFPZ's thus increasing probability that fire brands from torching trees will cross fire lines (reference spotting distances in the Fire Behavior Appendix)
7. Lack of a fully completed DFPZ's alters and/or delays suppression responses until control lines can be properly prepared. This delay leads to increased fire size and suppression cost, and places firefighters at risk when the work is completed as the wildfire is burning.

8. Fuels treatment costs over the next 20 to 30 years are expected to increase as biomass and tree densities continue to increase.

Summary: Fuels treatment strategies in Alternative 3 reduce surface fuels to the desired levels, but only partially decrease crown density to the desired level. Alternative 3 reduces ladder and surface fuels, thereby reducing the probability of trees torching from a wildfire initiated within the treatment unit. However deferral of treatments that reduce crown fuels (canopy bulk density) to desired levels would leave portions of the proposed DFPZ's with moderate to high crown fire potential from a wildfire that is initiated outside of the treated areas.

The elimination of 3,444 acres of treatments diminishes the effectiveness of the proposed DFPZ's. A high likelihood for fire control problems and "spotting" across fire lines would still exist due to the remaining high levels of surface, ladder and crown fuels and the resulting potential for crown fire within the proposed DFPZ's.

The deferral of treatments in units:

- 138, 139, 307, 310 and 311 leaves an untreated gap of approximately 1 mile in the proposed DFPZ adjacent to the Twin Mountain IRA and provides unobstructed pathway for wildfire to move between IRA and upper Anthony Creek drainage.
- 119, 120, 121, 122, 123, 124, 126, 128, 129, 131, 133 and 134 leaves an untreated gap along the 73 road adjacent to the Rock Creek/Bulger WUI and provides unobstructed pathway for wildfire to move from the IRA into the WUI.
- 64, 65, 66, 69 and 71 create gaps in the DFPZ along forest service road 4350.The ability to compartmentalize wildfire within the North Anthony Creek drainage is decreased.
- 93 and 95 decrease the width of the DFPZ along forest service road 4380. The decrease width of the DFPZ provides a higher probability that a fire brand will ignite a spot fire across control lines.
- 14, 15, 16, 51, 56, 58, 62 and 144 decrease the width and create gaps in the proposed DFPZ adjacent to the Beaver Creek IRA.
- 19, 21, 36 and 37 decrease the width of the DFPZ along forest service road 4315.
- 39, 40, 41, 42 and 76 decrease the width and create gaps in the DFPZ adjacent to private property thus increasing the potential that suppression actions will be implemented on state or private lands.

***ALTERNATIVE* 4**

Alternative 4 modifies the proposed action by changing 3,878 acres of commercial activities to noncommercial and eliminates all treatments in Moist/Cold PVG in priority 3 units.

Treatments not changed from the proposed action would have the same fire behavior modeled under Alternative 2 (Table 5). Units deferred from treatment consideration under this alternative would have fire behavior similar to that modeled under Alternative 1 (Table 3). Units that were changed from commercial to noncommercial would have fire behavior similar to what is modeled under Alternative 3 (Table 7).

In the priority area 2 treatment units that changed from commercial to noncommercial no trees above 7" DBH would be removed. This noncommercial treatment removes a portion of the ladder fuels but leaves the stand with higher than desired tree densities and crown fuel loadings (Reference Table 6). Mastication treatments would be ineffective due to the amount of material needed to be treated. All project generated material would be piled and burned on site reducing the surface fuel loading to desired levels. Treatments in these units would reduce the potential for crown fire initiation by reducing surface and a portion of the ladder fuels. But deferral of the commercial treatments would leave the crown fuel loading at levels that would support a crown fire if one were to be initiated outside the treatment unit (Reference Fire Behavior Appendix).

The Upper Grande Ronde and the Beaver Creek IRA's are located adjacent to the project area. The priority 2 treatments that were designed to create DFPZ's adjacent to these IRA's are only partially effective due to remaining high canopy fuel loadings from deferral of the commercial harvest. The potential for extreme fire behavior in these areas makes it more likely that suppression resources could be overwhelmed without an adequate DFPZ's located adjacent to forest roads 43, 4330, 4350 and 7312.

Prescribed fire treatments proposed in priority 2 units that have had the commercial removal deferred would be more prone to crown fire. The crown fire potential would remain at a moderate to high level decreasing opportunities to implement prescribe fire. The elimination of offsite biomass removal increases the amount of material that is piled and burned on site resulting in increased smoke emissions, increased damage to soils and increased mortality to the desired overstory.

Direct and Indirect effects of Alternative 4:

1. A reduction of surface and crown fuels and the associated fire intensity in priority area 1 similar to the proposed action.
2. The proposed DFPZ's would only be partially completed. The deferral of treatments would diminish the effectiveness DFPZ's reducing the probability of successful fire suppression.
3. The remaining high crown fuel loadings in the stands that had commercial removal deferred would provide a high potential for a crown fire from a wildfire that is initiated outside a treatment unit.
4. Increased biomass in priority area 2 would be burned on site due to the reduction in commercial removal. Smoke emissions may be noticeable to general public for long durations (over 48 hours).
5. Increased greenhouse gasses would be released during prescribed fires due to the increased biomass burned on site.
6. Wildfire intensity and severity continue increase in stands that were deferred from treatment. The risk of damaging impacts to soil, vegetation and visuals would continue.
7. Decreased forest resistance to fire, drought, insects and disease resulting from the high density of trees remaining in the untreated stands.
8. The deferred road maintenance would continue to prolong wildfire initial attack response times and decrease firefighter safety due poor egress routes.
9. Deferral of treatments and the decrease in width of DFPZ's increases probability that fire brands from torching trees will cross fire lines.
10. Cost of firefighting would remain high with a lack of completed DFPZ's to initiate suppression actions.
11. Treatment costs over the next 20 to 30 years are expected to increase as biomass and tree densities continue to increase.

Summary: Alternative 4 reduces surface, ladder and crown fuels to desired levels in the priority 1 treatment units. Deferral of the commercial treatments that reduce crown fuels (canopy bulk density) to desired levels in priority 2 units but would leave portions of the proposed DFPZ's with moderate to high crown fire potential from a wildfire that is initiated outside of the treated areas. A high likelihood for fire control problems and "spotting" across firelines in the priority 2 areas would still exist due to the remaining high levels of ladder and crown fuels and the resulting potential for crown fire within the proposed DFPZ's.

The elimination of 3,878 acres of commercial treatments designed to reduce crown fuel loadings coupled with the prescription change reduces the effectiveness of the proposed DFPZ's. The deferral of treatments in units:

- 66, 68-73 and 424 create gaps in the DFPZ along forest service road 4350.The ability to compartmentalize wildfire within the North Anthony Creek drainage is decreased.
- 1, 11-17, 46, 48-51, 55, 57-63, 144,147 and 341decrease the width and create gaps in the proposed DFPZ adjacent to the Beaver Creek IRA.
- 19, 21, 22 and 34 decrease the width of the DFPZ along forest service road 4315.
- 74, 102, 103, 112-116, and 145 decrease the width and create gaps in the DFPZ along the 7312. This increases the potential for a fire brand from a wildfire to spot across 7312 road thus increasing the potential that suppression actions will be implemented on state or private lands.

Implementation of Alternative 4 would eliminate the option for offsite removal of excess biomass in priority 2 areas. The treatment change from commercial to noncommercial would:

- Diminish the effectiveness of the proposed crown fuel reduction treatments (trees greater than 7"DBH would not be cut).
- Increase the amount of material pile burned. It is estimated that 25 tons of biomass/acre would need piled and burned, increasing the potential for soil damage and increasing probability smoke intrusions into the local community.

The elimination of all treatments in the Moist/Cold PVG in Priority area 3 units defers stand improvement activities such as density control and species conversation designed to improve the percentage of fire tolerant trees species.

ALTERNATIVE 5

Alternative 5 modifies the proposed action to include additional ground based commercial biomass removal in PCT, WFH and WFM units. Removing biomass off site will reduce the potential for smoke impacts by eliminating the need for pile burning on 2,560 acres. The additional 938 acres of treatments added to the proposed action would increase the width of the proposed DFPZ's and improve stand health.

Treatments proposed in Alternative 5 modify vegetative structure and fuel loadings to reduce wildfire similar to what was modeled under Alternative 2 (Table 5). The DFPZ's created provide a fire suppression anchor point to reduce the potential wildfire behavior. These DFPZ's would result in the compartmentalization of the project area, providing fire managers with options to utilize confine and contain suppression strategies decreasing the potential for large wildfires.

The DFPZ's constructed adjacent to roads and the associated road maintenance would improve firefighter's response times and provide safe egress from a fire if needed.

Alternative 5 moves fire adapted ecosystems in the drier lower elevations portions of the project area towards their range of historic conditions. Fire would be reintroduced into the project area, surface fuel loadings would decrease, and the gap in vegetation profiles between historical conditions and current conditions would decrease.

The duration of the effectiveness of the fuels reduction treatments are similar to Alternative 2.

Direct and Indirect effects of Alternative 5:

1. A reduction of surface and crown fuels reduces the potential for extreme fire behavior.
2. Flame lengths would be reduced to 1-3 feet on treated acres.
3. The creation of DFPZ's in strategically sound locations to initiate suppression operations, increasing the probability of success.
4. Crown fire potential is reduced to desired levels.
5. Creation of DFPZ's in the Rock Creek Bulger and Anthony Lakes WUI decrease risks to private property and recreation residences from fire.
6. Reduction of surface and ladder fuel increases prescribed burning opportunities and decreases potential smoke emissions.
7. Creation of DFPZ adjacent to the Twin Mountain, Upper Grande Ronde and Beaver creek IRA's increases suppression options and increases firefighter safety.
8. Prescribed fire treatments would produce fewer smoke emissions and less greenhouse gasses due to the increased biomass utilization.
9. Reduced wildfire intensity and severity lessen the risk of damaging impacts to soil, vegetation, watersheds, and visuals.
10. Increased forest resistance to fire, drought, and disease from decreased density of trees.
11. The increased road maintenance would improve wildfire initial attack response times and increase firefighter safety by improving egress routes.
12. Fuels treatments would decrease the amount of smoke emissions generated from a wildfire. Smaller less intense fires would produce less smoke.
13. Creation of safe egress routes for suppression resources due to a reduced surface fuel loading adjacent to major road systems.
14. Reduced probability that fire brands from torching trees will cross fire lines constructed in DFPZ's.

Summary:

Alternative 5 meets the purpose and need of this project by using a combination of silvicultural and fuels reduction treatments designed to reduce surface, ladder and crown fuels. Thinning treatments would leave the largest, healthiest trees on site to provide shading of surface fuels and sheltering from wind. Smaller diameter tree densities would be reduced, canopy base heights raised and surface fire intensity reduced minimizing the potential for crown fire initiation. This partially shaded gap between the surface and crown fuels would reduce the potential for crown fire.

Implementation of Alternative 5 would increase the offsite removal of excess biomass by 3,499 acres. Prescription changes from noncommercial to commercial would:

- Decrease surface fuels loads to desired levels without expensive hand pile or mastication treatments.

- Decrease the amount of pile burning thus reducing the probability for smoke intrusions into the local communities.

The additional 938 acres of treatments that are added to the proposed action would increase the width of the proposed DFPZ's and improve stand health through thinning.

B. AIR QUALITY

Air resources are somewhat unique in that, the past impacts to air quality are not usually evident. While smoke emissions during summer and early fall months are primarily from wildfires and agricultural burns, smoke during the spring and later fall months primarily result from Federal prescribed fire activities (BLM and FS) in Northeast Oregon and Western Idaho. Federal land managers currently coordinate to manage the cumulative effects of prescribed burning across Northeast Oregon. Private landowners treating forest fuels in locations under the protection of Oregon Department of Forestry are required to follow the advice of the Department's smoke management forecaster when burning. Emissions data was described for the action alternatives below was derived from BlueSky Playground 2.0 beta

Other emission concerns include summer wildfires, agricultural burning, and home heating in local communities. Both wildfires and agricultural burning typically occur mid- to late-summer. Home heating is generally limited to the winter months. In all three instances, the additional emissions produced are low and are not expected to impact air quality at the time prescribed fire activities are planned.

ALTERNATIVE 1

Wildfire is a primary source of unintentional carbon emissions from forests in western United States (Stephens 2005), and can lead to widespread loss of centuries' worth of carbon storage. This effect will likely be exacerbated in coming decades under continued warming, with increasingly severe fire. Treatments in the action alternatives are designed to limit wildfire size to 500 acres or less, thus reducing emissions. Modeling was conducted to estimate the amount of greenhouse gasses that were released during the Anthony Creek to fire in 1960 to what be admitted from 500 acre fire today.

Tons of Greenhouses gasses Released
Anthony Creek Fire (15,000 acres) – 909,526 tons
500 Acre Fire within DFPZ (post treatment) – 30,317 tons

ALTERNATIVES 2 and 5

The use of prescribed fire in this area could create a short-term smoke impact. This would be transient and may last for more than 72 hours per occurrence. Prescribed burns would be planned so that factors such as wind direction and air mass stability would help limit the effects of smoke (e.g. smell, eye irritation) on local residents, campers, or the general public. In the evenings, the residual smoke would tend to follow the local wind patterns, and flow down slope into the Baker valley. Experience from several burns in the area has shown that the effects of this smoke can be minimized by controlling length and time of ignition and burning under favorable mixing conditions for smoke dispersion. Local residents would be contacted and appropriate safety signs and other methods would be used to warn motorists. Fire managers would select areas to be burned that optimize natural smoke dispersion and minimize local exposure to adverse smoke impacts.

The additional removal of biomass off site on 3,499 acres in the Alternative 5 would reduce emissions (PM10) in grapple pile units by 57% over those in Alternative 2. The additional acres of non-ground based harvest systems combined with additional acres of hand pile burning in noncommercial treatments would increase emissions of PM10 from hand pile burning by 46% in Alternative 5.

Table 4 - Projected emissions from Alternative 2 Prescribed Fire Treatments (tons)

Emission	Activity Fuels	Natural Fuels	Grapple Pile	Hand Pile	Total
PM10	872	1,003	1,139	252	**3,266**
PM2.5	753	869	977	210	**2,809**
CO	8,598	10,295	5,534	1,219	**25,646**
CO2	99,525	103,417	241,901	53,538	**498,381**
Green House Gasses (GHG's)	118,583	126,145	257,606	56,989	**559,323**

Table 10 - Projected emissions from Alternative 5 Prescribed Fire Treatments (tons)

Emission	Activity Fuels	Natural Fuels	Grapple Pile	Hand Pile	Total
PM10	941	1,003	485	471	**2,900**
PM2.5	813	869	416	393	**2,491**
CO	9,281	10,295	2,355	2,279	**24,210**
CO2	107,438	103,417	102,958	100,072	**413,885**
Green House Gasses (GHG's)	128,011	126,146	109,643	106,523	**470,323**

ALTERNATIVE 3

The elimination of offsite biomass removal increases the amount of material that is piled and burned on site resulting in increased smoke emissions, increased damage to soils and increased mortality to the remaining overstory trees.

Table 8 - Projected emissions from Alternative 3 Prescribed Fire Treatments (tons)

Emission	Activity Fuels	Natural Fuels	Grapple Pile	Hand Pile	Total
PM10	620	906	759	371	2,656
PM2.5	536	786	651	309	2,282
CO	6,119	9,306	3,687	1,792	20,904
CO2	70,838	93,485	161,193	78,702	404,218
Green House Gasses (GHG's)	84,403	114,031	171,658	83,776	453,868

ALTERNATIVE 4

Prescribed fire treatments proposed in priority 2 units that have had the commercial removal deferred would be more prone to crown fire. The crown fire potential would remain at a moderate to high level decreasing opportunities to implement prescribe fire. The elimination of offsite biomass removal increases the amount of material that is piled and burned on site resulting in increased smoke emissions, increased damage to soils and increased mortality to the desired overstory.

Table 9 - Projected emissions from Alternative 4 Prescribed Fire Treatments (tons)

Emission	Activity Fuels	Natural Fuels	Grapple Pile	Hand Pile	Total
PM10	627	996	1373	492	3488
PM2.5	541	864	1177	410	2992
CO	6,182	10,230	6,671	2,377	25,460
CO2	71,567	102,767	291,619	104,402	570,355
Green House Gasses (GHG's)	85,270	125,353	310,552	111,132	632,307

Alternative Summary for Fire Behavior and Air Quality

Treatments proposed in all the action alternatives reduce potential fire behavior in all modeling groups; more of this occurs in Alternatives 2 and 5 than in Alternatives 3 and 4. The primary difference in Alternative 4 is the conversion of treatments to non-commercial which would not reduce the canopy fuel loadings and still leave many areas at risk. The potential for torching is reduced; fire intensity measured by flame length and rates of spread are reduced in all action alternatives over the no action alternative. Flame lengths and fire rates of spread are reduced in the action alternatives to the point that fire sizes are predicted to be less than 1 acre in size after one hour in comparison to the 59-85 acres if left untreated under Alternative 1 (Table 14). Due to the deferral of canopy fuel treatments in Alternatives 3 and 4 the potential for a crown fire remains high in portions of the proposed DFPZ's.

As described under Alternative 1 above, the ability to control a fire at 500 acres after fuel reduction treatments would produce 97% fewer greenhouse gas emissions than was released by a 15,000 acre wildfire.

Table 14 - Fire Behavior Comparison by Alternative

Indicators	Alternatives				
	1	2	3	4	5
Modeling Group 1- Dry Upland Forest					
Fire Rate of Spread (chains/hr)	48	3	6	6	3
Fire Flame Length (feet)	45	2	3	3	2
Canopy Base Height (ft)	1	21	6	6	21
Fire size 1 hour after ignition (ac)	63	.3	.9	.9	.3
Torching Index	0	496	39	39	496
Crowning Index	42	70	45	45	70
Modeling Group 2 – Cold Upland Forest					
Fire Rate of Spread (chains/hr)	52	3	3	3	3
Fire Flame Length (feet)	54	1	1	1	1
Canopy Base Height (ft)	3	9	8	8	9
Fire size 1 hour after ignition (ac)	85	.2	.2	.2	.2
Torching Index	0	255	225	225	255
Crowning Index	26	45	31	31	45
Modeling Group 3 – Moist Upland Forest					
Fire Rate of Spread (chains/hr)	43	3	5	5	3
Fire Flame Length (feet)	46	1	3	3	1
Canopy Base Height (ft)	2	14	12	12	14
Fire size 1 hour after ignition (ac)	59	.3	.7	.7	.3
Torching Index	0	376	138	138	376
Crowning Index	36	52	36	36	52

Table 15 - Alternative Summary comparison on the effects of "Modifying Fire Behavior Potential"

Indicator	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Crowning Index	Crown fire Potential remains high due to the low canopy base heights, high crown fuel loadings and abundant ladder fuels.	Crown fire potential is decreased due to high canopy base heights; reduced crown fuel loadings and the elimination of ladder fuels.	The deferral of treatment units under this alternative leaves critical areas within the proposed DFPZ's with higher than desired crown fuel loadings.	The deferral of commercial activities in priority area 2 treatment units leaves the stands at risk to crown fire due abundant ladder and crown fuels remaining in the units.	Crown fire potential is decreased due to high canopy base heights; reduce crown fuel loadings and the elimination of ladder fuels.
Torching Index	The potential for torching to occur remains high due to the low canopy base heights, high crown fuel loadings and abundant ladder fuels.	Torching potential is decreased due to high canopy base heights; reduce crown fuel loadings and the elimination of ladder fuels.	The deferral of treatment units under this alternative leaves critical areas within the proposed DFPZ's with abundant ladder fuels and potential for torching.	The deferral of commercial treatments leaves stands with a high potential for torching due to the abundant ladder fuels within the treatment area.	Torching potential is decreased due to high canopy base heights; reduce crown fuel loadings and the elimination of ladder fuels.
Fire Rate of Spread	Rate of fire spread exceeds production rates of initial attack crews in direct attack methods. These conditions will continue to limit firefighting opportunities, pose undesirable risk to private property, firefighter and public safety.	Rate of fire spread is reduced to a level that initial attack crews can utilize direct attack methods. Firefighting opportunities are increased, risk to private property, firefighter and public safety are reduced.	Deferral of treatment units leaves critical areas within the proposed DFPZ's with higher than desired fire rates of spread. Increases the potential for a wild fire to escape initial attack.	Priority 2 treatment units would continue to have crown fuel loadings that are capable of producing high fire spread rates.	Rate of fire spread is reduced to a level that initial attack crews can utilize direct attack methods on an additional 938 acres. Firefighting opportunities are increased, risk to private property, firefighter and public safety are reduced.
Fire Flame Lengths	Flame lengths would exceed the ability of suppression crews to utilize direct attack options. Fire suppression tactics would be indirect thus increasing fire size.	Fire flame lengths would be reduced to 1-3 feet on treated acres. Direct fire suppression tactics decreases the potential fire size; reduce the risk to public and firefighters and private property.	Deferral of treatment units leaves critical areas within the proposed DFPZ's with higher than desired flame lengths and increases the potential for a wild fire to escape initial attack.	Surface fuels are reduced similar to Alternative 2 producing similar flame lengths. The deferral of commercial treatments leaves stands with a high crown fuel loading capable of producing intense fire behavior.	Fire flame lengths would be reduced to 1-3 feet on an additional 938 acres. Direct fire suppression tactics decreases the potential fire size; reduce the risk to public and firefighters and private property.
Canopy Base Heights	Canopy base heights remain low. Trees have a high potential to torch. and crown fire potential remains high.	Canopy base heights are increased within the DFPZ's and crown fire potential is reduced.	Deferral of treatment units leaves critical areas within the proposed DFPZ's with low canopy base heights and the potential for a crown fire is high.	Canopy base heights are increased but the lack commercial treatment leaves portions of the treatments units at risk to crown fire.	Canopy base heights are increased within the DFPZ's and crown fire potential is reduced.

Indicator	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Crown Fire Potential	Crown fire potential remains high.	Crown fire potential is reduced within the DFPZ's.	Crown fire potential remains high in the areas that were deferred from treatment.	Priority area 2 units will have crown fire initiation decreased but would still have canopy fuel loadings that would support crown fire..	Crown fire potential is reduced on an additional 938 acres.
Emissions from Fire	No prescribed fire emissions. Wildfire fires would generate large amounts of emissions due fire size and availability of fuels.	Mechanical treatments which optimize biomass utilization would decrease the amount of pollutants generated during a prescribed burn or wildfire. Smaller less intense fires would produce less smoke.	Reduction in treatment acres reduces the amount of prescribed fire emissions. Wildfire fires would generate large amounts of emissions due fire size and availability of fuels.	Reduced biomass utilization increases the amount of material burnt on site increasing the amount of prescribed fire emissions per treatment acre.	Increased biomass utilization reduces the amount of material burnt on site decreasing the amount of emissions per treatment acre.
DFPZ's / Compartmentalization of the project area.	Lack of compartmental-ization exists, wildfires have a high potential to spread throughout project area. WUI's and private property are high risk from wildfire. High potential for wildfire to spread from the IRA's into the project area.	Completed DFPZ's provide a compartmental-ization of the project area that would decrease wildfire size; reducing risk to private property and WUI's. Creates DFPZs adjacent to the IRA's.	Compartmental-ization would be partially completed. Deferral of treatment units would create gaps in the DFPZ's.	Compartmental-ization would be partially completed. Deferral of treatments and prescription changes would create gaps in the DFPZ's.	Completed DFPZ's provide a compartmental-ization of the project area that would decrease wildfire size and risk to WUI's and private property. An additional 938 acres of treatments would increase the width of the DFPZ's.
IA Response Time	Responses times are delayed due to lack of road maintenance.	Response times are decreased with the proposed road reconstruction and maintenance.	Responses times are delayed due to lack of road maintenance.	Responses times are delayed in priority area 2 due to lack of road reconstruction and maintenance.	Response times are decreased with the proposed road reconstruction and maintenance.

Cumulative Effects on Fire Behavior Potential & Air Quality

ALTERNATIVE 1

The no action alternative would leave thousands of acres of public land with an existing hazardous fuels profile adjacent to private land, thus increasing the risk of a wildfire originating on forest land and spreading across ownership boundaries. Stand replacing fire events would result in the loss of old forest, wildlife habitat cover, and consumption of large woody material and structure in riparian areas. Fuels reduction treatments designed through collaborative efforts would be differed from treatment.

Values at risk including improvements, wildlife habitat, private lands, and visual concerns within and adjacent to the analysis area will continue to drive protection from disturbance events, primarily wildfire. Without treatment, fuel loading associated fire risk and fire regime departure will continue to increase, ultimately resulting in vegetative conditions that will support increasingly

intense burning conditions. Climatological changes over time may compound these conditions if the predicted changes towards warmer, drier conditions come to pass. Resistance to control, suppression costs, and exposure or risk to personnel managing wildfires can be expected to increase. Similarly, managing natural ignitions for beneficial objectives will become more difficult as fire intensity increases.

ALTERNATIVES 2, 3, 4, and 5

The effects of the action alternatives contribute to the trend toward a decrease in "fire behavior potential" begun by previous treatments in the area. Ongoing projects on both public and private lands on the east face of the Elkhorn's are very similar in types of treatments proposed in the action alternatives in this project (commercial and non-commercial thinning, improvement cuts, and surface fuels reduction treatments). In combination with the East Face project these projects increase safe firefighting options for wildfire suppression no matter where the fire originates (State, private, or federal lands (including BLM). All of these treatments are adjacent to Priority Area 1 treatments on federal lands which will improve the effectiveness of the DFPZs established in these areas. These improved DFPZs increase the probability of successful efforts to control wildfires and keep fires much smaller in size.

Grazing reduces the fine fuel loading in the natural openings improving the efficacy of fuel reduction actions in DFPZs in East Face alternatives. Active allotments may have the grass reduced to a level that reduces fire spread rates. Livestock grazing is not expected to impede progression toward historic fire return intervals.

Increasing access by opening up stands and roads may contribute to an increased potential for human caused fires within the project area. Alternatives 2 and 5 would open the most roads and build the most temporary roads; therefore, those alternatives in combination with motor vehicle use (including cross-country) would have the highest potential for increased human caused fire starts. Implementation of the travel management rule designating roads, trails, and areas for public motor vehicle use would manage cross-country motor vehicle use and provide a means of enforcement on roads and trails not designated for motor vehicle use which would reduce the potential for human cause fires in the future.

Fire wood cutting would most likely be focused on cutting in slash piles in the fuel reduction areas or untreated areas along DFPZs, this will further reduce down fuels and the potential emissions from pile burning. There is a slight chance that firewood cutting during the summer months may also contribute to potential human caused fires ignited in the project area.

La Grande Municipal water shed is adjacent to the project area. The actions proposed under this document combined with Limber Jim, Horse Fly and Ladd TSI will reduce the potential for a wildfire to burn into the watershed or stop a fire coming out of it.

ROW work by OTEC to protect the power line will enhance the proposed DFPZs which are adjacent to and surrounding the power line in the East Face project area. These treatments in combination will reduce fire behavior and improve the effectiveness of the DFPZs while protecting the power line.

The cumulative effects of ongoing and future projects, combined with the proposed activities, move several thousand acres of fire adapted plant communities (fire regimes 1 and 3) closer to historic conditions at the landscape level.

Prescribed burning in the East Face project area in combination with prescribed burning on State, private, and adjacent public lands could produce short term smoke intrusions into nearby sensitive areas. However, smoke emissions would be managed to meet the Clean Air Act on federal lands.

Summary

The proposed treatments within this document along with ongoing and proposed treatments on private, State and adjacent National Forest would reduce the potential for a large, high intensity wildfire on the East Face of the Elkhorn's. Suppression forces would have a higher probability of successfully attacking a wildfire on public lands thus limiting fire size and the potential to spread off public lands. Treatments proposed in combination with the efforts to managing fuels on adjacent privately owned lands would decrease risks to private property and allow wildfire suppression resources to be utilized in higher priority areas throughout the forest during times of increased wildfire activity.

Climate change and fire

Climate change is a global issue that results from global Greenhouse Gas (GHG) emissions. From a quantitative perspective, there are no dominating sources and fewer sources that would even be close to dominating total GHG emissions. The global climate change issue is the result of numerous and varied sources, each of what might seem to make a relatively small addition to global atmospheric GHG concentrations. The Council on Environmental Quality recommends that environmental documents reflect this global context and be realistic in focusing on ensuring that useful information is provided to decision makers for actions that the agency finds are a significant source of GHGs. The proposed treatments under this analysis will not produce a significant amount of GHG.

While it is well documented that human activities have added greenhouse gases to the atmosphere, mainly through the burning of fossil fuels and clearing of forests, the activities proposed in this project were designed with adaptation strategies (actions that help ecosystems accommodate changes adaptively) and mitigation strategies (actions that enable ecosystems to reduce anthropogenic influences on global climate, *Milar, 2007*).

The combined effects of droughts and insects may lead to a pulse of tree mortality that increases the potential for intense fires. There are short- and long-term facets to the increase in potential fire intensity. In the short-term, warmer, drier conditions will limit the capacity of the ecosystem to maintain the quantity of vegetation currently growing on site. As this stress continues, vegetative capacity to resist insect, disease, and other disturbance mechanisms is reduced and the potential for mortality increases. Increased mortality provides additional available fuel for wildfire, thus increasing fire potential. Once the dead foliage drops, this danger may be considerably reduced for a few years. However, as the trees decay over the next decade or so following the pulse of mortality, they fall and can help create and accumulation of large, heavy fuels. These large fuels contribute to a longer-term potential for intense fires since they may take many years to decompose, especially in the dry environments of the West.

Even in the absence of increased mortality from either drought or insects, a warming climate would likely alter fire regimes in ways that would make it more difficult to manage forests influenced by many decades of fire suppression and other activities. Climate change influences fire regimes in complex ways due to differentials in responses to variation in temperature and precipitation regimes. Both tree-ring records and modeling indicate that the probability of having fires is primarily

driven by temperature, whereas the extent and intensity of fires is driven more strongly by precipitation patterns. Warmer temperatures lead to an earlier onset and later end for the drying period, thus increasing the probability of a fire during the longer fire season. Precipitation influences the growth of vegetation (fuel). The amount of precipitation during the wet season will influence the amount of fuel produced.

All action alternatives manage the forest ecosystem so that it is better able to accommodate climate change and to respond adaptively as environmental changes accrue. The action alternatives encourage gradual adaption to change to a warmer and drier environment by favoring disease and fire resistant trees, reducing stand density, and lowering fuel loadings. This would reduce the potential for catastrophic conversion due to climate change driven disturbance factors that are forecasted (see Forest Vegetation section).\

Adaptive strategies included within the treatment design:

1. Resistance options – manage forest ecosystems and resources so that they are better able to resist the influence of climate change or to stall undesired effects of change.

2. Promote resilience to change – resilient forests are those that not only accommodate gradual changes related to climate but tend to return toward a prior condition after disturbance either naturally or with management assistance. Promoting resilience is the most commonly suggested adaptive option discussed in a climate-change context (Dale et al. 2001, Price and Neville 2003, Spittlehouse and Stewart 2003). Forest management techniques such as prescribed burning or thinning dense forest, can make forest more resilient to wildfire and decrease fire emissions.

3. Enable forest to respond to change – This group of adaptation options intentionally accommodates change rather than resist it, with a goal of enabling or facilitating forest ecosystems to respond adaptively as environmental changes occur (Milar, 2007).

The following are mitigations strategies incorporated into treatment design:

1. Restore healthy forest so that carbon can be efficiently stored in live trees

2. Reduce emissions by reducing surface fuel loadings.

3. Reduce density of small diameter trees. One means of slowing the release of sequestered carbon is to increase forest resistance to fire, drought, and disease, by reducing the density of small trees *(Stephens and Moghaddas, 2005)*.

/s/ *Mike Johnson*

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